SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Sum the series $\sum_{n=1}^{\infty} \frac{n^2+3}{n+2} \frac{x^n}{n!}$.

17. Solve the equation

$6x^6 - 35x^5 + 56x^4 - 56x^2 + 35x - 6 = 0$.

18. Find the eigen values and eigen vectors of the matrix $\begin{bmatrix} 3 & -1 & 3 \\ -1 & 5 & 1 \\ 3 & 1 & 5 \end{bmatrix}$.

19. Solve the following equation by Cramer's rule.

$x + 2y + 5z = 23$

$3x + y + 4z = 26$

$6x + y + 7z = 47$

20. Expand $\sin^3\theta\cos^5\theta$ in a series of sines of multiples of θ.

APRIL/MAY 2024

FAEL12/CAEL12 — BASIC MATHEMATICS – I

Time : Three hours Maximum : 75 marks

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SECTION A — (10 × 2 = 20 marks)

Answer ALL the questions.

1. Write the expansion of $(1+x)^n$.

2. Show that the co-efficient of x^n in the infinite series $1 + \frac{b+ax}{1!} + \frac{(b+ax)^2}{2!} + \ldots + \frac{(b+ax)^n}{n!} + \ldots$ is $\frac{e^b a^n}{n!}$

3. Define reciprocal equation.

4. Find the upper limit of the roots for the equation $x^4 - 2x^3 - 13x^2 + 38x - 24 = 0$.

5. Define orthogonal matrix.

6. State Cayley Hamilton theorem.

7. Find the adjoint of the matrix $A = \begin{bmatrix} 4 & 5 \\ 6 & 7 \end{bmatrix}$.

8. If $A=\begin{bmatrix}1 & -2\\ 3 & 4\end{bmatrix}$ and $B=\begin{bmatrix}3 & 2\\ -1 & 0\end{bmatrix}$ find $3A+2B$.

9. Write the expansion of $\tan n\theta$.

10. If $x=\cos\theta+\sin\theta$ then find $x+\frac{1}{x}$ and $x-\frac{1}{x}$.

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SECTION B — (5 × 5 = 25 marks)

Answer ALL questions.

11. (a) Resolve into partial fractions $\frac{2x+1}{(x-1)(x^2-1)}$.

Or

(b) Sum the series to infinity

$\frac{15}{16}+\frac{15.21}{16.24}+\frac{15.21.27}{16.24.32}+\ldots$

12. (a) Remove the fractional co-efficients from the equation $x^3+\frac{3}{2}x^2+\frac{5}{18}x+\frac{1}{108}=0$.

Or

(b) Diminish by 3 the roots of the equation $x^5-4x^4+3x^3-4x+6=0$.

13. (a) Represent the matrix $\begin{bmatrix}2 & 1 & 4\\ 8 & -1 & 3\\ 3 & -5 & 0\end{bmatrix}$ as the sum of a symmetric and a Skew symmetric matrix.

Or

(b) If $A=\begin{bmatrix}1 & 2\\ 3 & 4\end{bmatrix}$, show that A satisfies the equation $A^2-5A-2I=0$.

14. (a) Find the value of the determinant $\begin{vmatrix}7 & 6 & 1\\ 5 & 3 & 8\\ 3 & 2 & 4\end{vmatrix}$.

Or

(b) Find the inverse of $A\begin{bmatrix}1 & 2 & 2\\ 2 & 1 & 2\\ 2 & 2 & 1\end{bmatrix}$.

15. (a) Express $\cos 8\theta$ in terms of $\sin\theta$.

Or

(b) Prove that

$\frac{\sin 9\theta}{\sin\theta}=256\cos^8\theta-448\cos^6\theta+240\cos^4\theta-49\cos^2\theta+1$